INFLUENCE OF THREE HOST PLANTS ON THE DEVELOPMENT, FERTILITY AND FECUNDITY OF THE GRASSHOPPER, *POECILOCERUS BMTONIUS*

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INTRODUCTION

The grasshopper, *Poecilocerus pictus* eject a defensive fluid as an escape measure against the attack of predators (Sreenivasulu *et al*, 1996). For this reason, the grasshopper, *Poecilocerus bmtonius* is more attracted to *Calotropis procera* plants for accepting its chemical defensive fluid (cardenolides), using it as a chemical defense against natural enemies. Plants use cardenolides against natural enemies including many herbivorous animals, parasites and pathogens (Harborn, 1988).

The highest percentage of *Schistocerca gregaria* egg hatch was recorded from parents feeding on *Chrozophora pennisetum*, while no egg hatch occurred when parents were fed on Sorghum plants. Maturation of *S. gregaria* are adversely affected by feeding on *Tribulus* , *Sorgum* and *Dipterygium* (Jackson *et al* , 1972). But Rao (1960) found that *Tribulus terrestris* allowed rapid maturation.

The importance of the various components of host plant in an insect's diet can be determined by assessing nymph growth rate and food utilization (Mattson, 1980 and Slansky and Wheeler, 1991). Rearing the grasshopper, *Euprepocnemis plorans* on lupine and horse bean caused significant reduction in fertility and ovariole yield of its first and second pods compared with those reared on clover (Elsayed, 1998).

The objective of the present study is to determine the effects of feeding foliages of the two host plants, *Zygophyllum simplex* and *Pulicaria crispa* on the reproduction of this grasshopper and evaluate its influence when the main host ,*C. procera* is absent.

MATERIAL AND METHODS

Egg masses were collected from routinely reared grasshoppers and incubated at 33°C in a closed jar until eclosion. Newly hatched nymphs were maintained on fresh mixed foliages from *C. procera*, *Z. simplex* and *P. crispa* at 30 C° and 50-70% RH and a 12:12 (L:D) photoperiod. Leaves of *C. procera*, *Z. simplex* and *P. crispa* were collected from the field and dried, then offered to test insects.

Newly emerged pairs originating from a single egg mass were individually reared in a 1-L glass jar covered with a cap fitted with a metal grid. A petri dish containing the tested plants and a wet piece of cotton as a source of water was placed in the jar. Eight pairs were reared on each of the three foliages. New dried leaves and wet cotton were provided daily. The glass jars were filled with moist sand after two weeks, and egg pods laid by the mated females were collected. Egg pods were counted and the sand was replaced. Egg pods were incubated at 30°C until hatching.The number of egg pods per female, eggs per pod, hatched nymphs per pod, the incubation period, mean number of ovarioles per ovary, resorption bodies per ovary and fecundity were recorded for each host foliage using the following formulas:

Fecundity= Total number of eggs per female

$$\text{Ovariole yield \%} = \frac{\text{Number of eggs per pod X 100}}{\text{Number of ovarioles eggs pc.: femal}}$$

$$\text{Fertility \%} = \frac{\text{Number of hatched eggs per pod X 100}}{\text{Number of deposited eggs per pod}}$$

RESULTS AND DISCUSSION

Longevity

Developmental time in days of *P. bmtonius* fed on the three host foliages is shown in Table (1). The longevity of immature adult females fed on *C. procera* was shorter (17.4±2.3 days). But the duration of immature adult females reared on *Z. simplex* was (28.6±2.1 days) and *P. crispa* (32.0±2.7 days), whereas longevity of mature adult females was not significantly different in females fed on the three host foliages. *P. crispa* increased the duration of immature adult females.

TABLE (I)

Developmental time in days (means ± S.D.) of mature and immature *P. bmtonius* fed on *C. procera, Z. simplex* and *P. crispa*

Host foliage	Immature adult females	Mature adult females
C. procera	17.4±2.3	48.8± 1.3
Z. simplex	28.6±2.1	44.1 ± 2.3
P. crispa	32.0±2.7	50.9 ± 3.4

Weight gain and resorption bodies

Table (2) shows that the weight gain of male and female adults reared on *C. procera* was significantly higher than those reared on *Z. simplex* or *P. crispa*. Also, the percentage of resorption bodies per ovary in females fed on *Z. simplex* or *P. crispa* was 100 % but it was 35 % in the ovary of females fed on *C. procera*. The mean number of ovarioles per ovary in females reared on *C. procera* was higher than that of females fed on *Z. simplex* or *P. crispa* .

TABLE (II)

Weight gain (fresh weight in grams) and ovary development of *P. bmtonius* fed on *C. procera, Z. simplex* and *P. crispa* (means ± S.D.).

Host	Weight of immature adults		Weight of mature adults		Weight gain		No. of ovarioles per ovary	Resorption bodies per ovary
	females	Males	females	males	females	males		
C. procera	1.83± 0.25	1.26 ± 0.34	3.35± 0.27	2.10± 0.36	1.52± 0.02	0.84 ± 0.03	121.0 ± 8.7	35.0± 2.9
Z. simplex	2.10± 0.62	1.29± 0.36	2.31± 0.56	1.40 ± 0.33	0.21± 0.06	0.11± 0.02	71.3± 26.9	100.0 ± 0.0
P. crispa	1.73± 0.25	1.30 ± 0.13	1.89± 0.25	1.40 ± 0.10	0.16±0.0 1	0.10± 0.03	97.8± 18.1	100.0 ± 0.0

Fecundity, fertility and ovariole yield

Number of pods per female, number of eggs per pod and number of hatched eggs per pod were significantly higher in females fed on *C. procera*, but females reared on *Z. simplex* or *P. crispa* laid no eggs (Table, 3). The percentage of fecundity, fertility and ovariole yield was normal in females fed on *C. procera*. Incubation period of eggs was 27 days and the period between two layings was 13 days.

Delaying of the sexual maturation of adult females reared on *Z. simplex* or *P. crispa* is attributable to ovary weakness. Ellis and Carlisl (1965) showed the stortage of certain nutrients, notably giberellins and monoterpenoids in senescent vegetation may lead to delayed maturation. Negative effects resulting from dietary components in *Lupinus termis* or *Vicia faba* caused prolongation of developmental

period (Elsayed, 1998). Similar observations were recorded after feeding *Schistocerca gregaria* on *Schouwia purpurea* (Elsayed, 1994). *S. gregaria* on *Pennisetum* , *Dipterygium* , *Tribulus* and *Chrozophora* plants supported rapid growth and development (Jackson *et al*, 1972).

TABLE (III)

Percentage of fecundity, fertility and ovariole yield of of *P. bmtonius* fed on *C. procera, Z. simplex* and *P. crispa* (means ± S.D.).

Host	Number of pods/ female	Number of eggs/ pod	Number of hatched eggs/pod	Fecundity %	Fertility %	Ovariole yield %	Duration of incubation in days	Period between two layings
C. procera	3.5 ± 0.54	113.9 ± 8.64	95.0± 4.50	94.9± 2.52	83.5± 2.9	94.1± 2.26	27.5± 1.60	13.6± 0.74
Z. simplex	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0
P. crispa	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0

Decrease of weight gain in the male and female adults of grasshopper on *Z. simplex* or *P. crispa* may be due to an effect on protein synthesis. This probability was confirmed when dissected females showed resorption bodies in ovarioles, the percentage was 100%. Low growth rate of *Ligurotetix coquilletti* female grasshopper on avoided shrubs was attributable to the low conversion rate of the digested food (Greenfield *et al*, 1989). The grasshopper, *Melanoplus sanguinipes* growth was significantly lower on kochia. Weight was reduced and duration of development increased on oats and kochia plant (Hinks *et al*, 1990 and Olfert *et al*, 1990). Increase of egg reabsorption % may depend on haemolymph proteins and fat bodies in females of *S. gregaria* on *S. purpurea* (Elsayed, 1994). Resorption bodies were significantly higher in the ovarioles of *E. plorans* females fed on *L. termis* or *V. faba* (Elsayed, 1998).

No reproduction which was recorded in the females reared on *Z. simplex* or *P. crispa*, may be due to failure to complete maturation of ovarioles or /and failure of production of yolk proteins in the haemolymph resulting from injurious components in these host plants. The percentage of egg resorption was 100% in females fed on *Z. simplex* or *P. crispa*. Fecundity and fertility of *E. plorans* fed on clover were significantly higher than those of females fed on either lupine or horse bean (Elsayed, 1998). Hatchability was 0.0% on sorghum sp. (Popov *et al*, 1984). Percentage of reproduction of the grasshopper *Melanoplus sanguinipes* on kochia

and oats was lower than that on wheat (Hinks *et al*, 1990 and 1991). The highest percentage of egg hatching in *S. gregaria* was recorded with parents feeding on *Chrozophora* and *Pennisetum* but it was 0.0% on *Sorghum* plants (Jackson, 1972).

SUMMARY

Feeding of adult grasshopper, *Poecilocerus bmtonius* on three host foliage; *Calotropis procera, Zygophylum simplex* and *Pulicaria crispa* was investigated by measuring immature and mature female longevities, weight gain, fertility and fecundity.The development of adult females were shorter on *C. procera* than those fed on other host foliages. Fecundity and fertility of females fed on *C. procera* were significantly higher compared with those reared on *Z. simplex* and *P. crispa.* Ovariole yield of females reared on Z. simplex or *P. crispa* was 0.0% as compared with females reared on *C. procera.* The rate of resorption bodies per ovary for females reared on Z. simplex or *P. crispa* was 100%. Weight gain in male or female adults reared on *C. procera* was higher than those reared on the other host foliages.

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